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14. ABSTRACT This Test Operations Procedure (TOP) provides testing guidelines for grenade launchers in a cold regions environment. The primary goal of this TOP is to outline procedures that will determine the performance, reliability, durability and safety of grenades launchers when exposed to a cold regions environment.						
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US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

*Test Operations Procedure 03-4-005A
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COLD REGIONS - ENVIRONMENTAL TESTING OF GRENADE LAUNCHERS

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*This TOP supersedes TOP 03-4-005, Arctic Environmental Test of Grenade Launchers, 29 May 1969.

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1. SCOPE.

a. The procedures specified in this Test Operation Procedure (TOP) are designed to allow evaluation of the effectiveness and suitability of grenade launchers in the cold regions environment; both weapon mounted (e.g. the M203 and M320) and standalone (e.g. the MK19 and M79) models. These procedures do not include testing required to address Smoke Grenade effects (cloud size, dispersion characteristics, wind, icing, etc.) which may be different for cold weather conditions. Engineering tests of weapons are conducted to determine the characteristics and performance of the weapons under various conditions of operation and to ensure their compliance with specified requirements. Information is presented to familiarize testers, operators, and crews with special procedures and techniques to test the grenade launchers effectiveness and suitability in a cold regions environment.

b. Metals become brittle at cold temperatures; therefore, metal parts cannot withstand the same shock loads they can sustain at higher temperatures. Different metals expand and contract at different rates for a given change in temperature. This may lead to a change in clearance and tolerances, which can affect weapon operation.

c. Weapons are affected by common conditions of the cold regions and the resulting effects on material properties; such as, increased viscosity of lubricants, dissimilar metal expansion/contraction rate, accumulation of frozen moisture, and failure of seals. Because chemical reactions slow down as the temperature decreases, propellants in munitions may have a slower burn rate.

d. Ice fog resulting from the exhaust from weapons firing reduces visibility in the immediate area and may prevent target acquisition. Over-lubricating in cold weather may cause parts to bind, resulting in misfires. It is important to keep machined surfaces clean and not over-lubricated. An arctic grade lubricant must be used to avoid the lubricant becoming too viscous as the temperature drops.

e. When weapons, parts, or assemblies are brought indoors after having been outside at low temperatures, water vapor in the warm air condenses on the cold parts. The condensation causes corrosion if not immediately removed and if a significant enough of a buildup occurs it could cause the weapon to malfunction. Damage to weapons systems and components can be caused by ice accumulation, as well as the de-icing techniques, such as tools or de-icing fluids used to remove ice.

f. In order to properly characterize the weapon system under test, these potential hazards are best addressed through natural environmental testing. Methods for testing grenade launchers for the effects of these potential cold regions hazards are the primary goal of this TOP.

g. Limitations. The procedures outlined in this TOP are limited to the testing of grenade launchers in the cold regions environment. Procedures for testing grenade launchers under non-cold conditions are outlined in TOP 03-2-030^{1**}.

**Superscript numbers correspond to Appendix B, References.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

2.1.1 Firing Ranges and Ammunition Supply.

a. A firing range must be available that can be utilized to fire the grenade launcher under test. This area must be in a location commensurate with the natural environment and un-groomed.

b. A heated enclosure located adjacent to the firing range is required to house the test team, instrumentation, and provide a safe refuge in case of a safety issue. The heated enclosure can also be used as a location to install any required test instrumentation on the test items.

c. A temporary Ammunition Supply Point (ASP) may be required to address storage needs and overcome distance limitations to the test site per Hazard Classification of United States (US) Military Explosives and Munitions Revision 12².

d. The amount and type of ammunition, propellants, and fuses required for the test must be determined and provided to the Test Center's Ammunition Manager with enough lead time to plan for the transportation and storage of the items.

e. Coordination with ammunition specialists for delivery from the ASP to the test site must be accomplished in sufficient time to ensure delivery. Ammunition can be cold conditioned, then delivered to the test site if required.

f. If ammunition at the test site becomes colder than the allowed lower limit for firing, it must be transported back to the ammunition bunker and allowed to warm to acceptable temperatures. In order to accomplish this task, instrumentation for monitoring ammunition temperatures to ensure compliance with operational limits will need to be provided.

2.1.2 Courses.

a. A heated enclosure located adjacent to the relevant test course is required to house the test team and instrumentation and provide a safe refuge in case of a safety issue. The heated enclosure can also be used as a location to install any required test instrumentation on the test items.

b. A three to five mile natural environment test course suitable for determining functional performance characteristics of the grenade launchers under test will be required. The course should include varied subarctic terrain, vegetation, and snow/ice conditions prevalent through the temperature ranges applicable to the test item. Slopes along the course must be of sufficient grade for uphill, downhill, and side hill traverses applicable to real life operational conditions.

2.1.3 Administrative.

a. Office space with adequate heat, lighting, and ventilation must be provided to the test team and test participants. Existing facilities should be used when feasible. Telephones, computer access, office equipment, and any special requirements to support the test must be identified and in place prior to the start of testing. Computer and network access requires approval and may require additional arrangements to accommodate non-government testers, customers, contractors, or support personnel. These approvals must be coordinated with the Information Security Officer early in the test planning process.

b. On some tests portable/mobile trailers, tents, and portable warm-up buildings may be used and should be positioned as close to the test site as possible. Briefing areas as close to the test equipment as practical will facilitate the flow of information between the Test Officers and the test team members. Heat and generated power to support these mobile facilities must be available and able to function in temperatures as low as -46 degrees Celsius (°C) (-50 °Fahrenheit (F)).

c. Latrine facilities (portable toilets) need to be contracted/requisitioned if they are needed at remote test sites.

d. Since some equipment may require testing in locations distant from the established test sites because of altitude, changing temperature, or marine environment, considerations for temporary portable maintenance, and/or administrative facilities such as vans/expandable vans, trailers, and tents or tarps to support test operations should be made.

e. If military personnel are required, ensure a Test Schedule and Review Committee (TSARC) request is submitted within one year from the start of testing or as early as possible.

2.2 Instrumentation.

A wide range of instrumentation must be available to measure and record the prevailing meteorological conditions and the performance and durability of the test items. TOP 01-1-004³ outlines special considerations for instrumentation requirements in a cold regions environment. Table 1 presents the general instrumentation requirements. Additional instrumentation from the general requirements listed in Table 1 may be required for specific test items or test scenarios; Table 1 is not all inclusive.

TABLE 1. GENERAL INSTRUMENTATION REQUIREMENTS

ITEM	DATA REQUIRED	DEVICE FOR MEASURING	PERMISSIBLE MEASUREMENT OF UNCERTAINTY ^a
Meteorological Data	Ambient Temperature	Digital Temperature Probe	-50 °C to 50 °C; ± 0.3 °C (-58 °F to 122 °F; ± 0.54 °F)
	Relative Humidity	Hygrometer	0 to 100 percent (%); ± 2 % -50 °C to 50 °C (-58 °F to 122 °F)
	Atmospheric Pressure	Digital Barometer	500 to 1000 hectoPascals (hpa); ± 0.15 hpa
	Wind Velocity	Digital Anemometer	0 to 100 Knots; ± 2 Knots
	Wind Direction	Digital Anemometer	0 to 360; ± 5 %
	Precipitation-Winter	Observer Collected	± 0.08 centimeters (cm) (0.03 inches (in.))
Meteorological Data	Precipitation-Summer	Digital Tipping Bucket	± 0.05 cm (0.02 in.)
	Solar Radiation	Digital Pyranometer	$\pm 14.90 \times 10^{-6}$ Volts (V)/watt/meter ²
Fluid Viscosity	Viscosity	Viscometer	± 0.2 % full scale range
Bore Diameter	Diameter	Star Gauge	± 1 micrometers (μ m)
Bore Inspection	Wear and Erosion	Borescope	Qualitative
^a The permissible measurement uncertainty is the two-standard deviation value for normally distributed instrumentation calibration data. Thus, 95 percent of all instrumentation calibration data readings will fall within two standard deviations from the known calibration value.			

3. REQUIRED TEST CONDITIONS.

3.1 Environment.

a. During testing, the ambient temperature, soil conditions, frozen ground conditions, presence of snow and ice on the surface, and falling snow must be recorded. These test conditions of climate, terrain, and vegetation that are found in the cold regions environment provide the critical and moderately severe environmental effects on equipment required for accurate testing. All testing in the cold regions environment should be concerned with those factors that have moderate to critical effects on the equipment under test. In order to address critical factors, grenade launchers should be tested under conditions that include cold temperature, falling snow, and surface snow and ice.

b. This TOP makes use of three cold categories designated as C1, C2, and C3 that refer to corresponding climatic categories defined in Army Regulation (AR) 70-38⁴. C1 category represents a day in which the ambient temperature ranges from a low of -31 °C (-25 °F) to a high of -18 °C (0 °F). C2 represents a day in which the temperature ranges from a low of -46 °C (-50 °F) to a high of -37 °C (-35 °F). C3 represents a day in which the temperature stays at the

low of -52 °C (-60 °F) and is considered a storage temperature. For the purposes of this TOP, and due to more accurate weather measuring devices now available since the creation of AR 70-38, the temperatures used for C2 range are from a low of -46 °C (-50 °F) to a high of -32 °C (-26 °F). These cold categories refer to the temperature conditions during the coldest day found in increasingly colder geographic areas.

c. During all testing the items under test will be operated in as wide a range of temperatures as available. However, the test effort will also be focused on ensuring tests are conducted and data accumulated in ambient air temperatures from -18 °C (0 °F) to -32 °C (-25 °F) and when required to temperatures below -32 °C (-25 °F) to the lowest ambient temperature available. Operations below -52 °C (-60 °F) will not be conducted unless otherwise directed.

d. Testing will continue regardless of adverse weather conditions, except when conditions will compromise test results or endanger life or property. Preventive maintenance, checks, and services (PMCS) will be conducted outdoors on the equipment to obtain PMCS data. The length of cold-soak periods and ambient air temperatures will be recorded during each subtest, as appropriate. Any mission limitations or mission aborts caused by reaching lower temperature threshold limits will be recorded and reported.

3.2 Test Item Configuration.

a. All test items will be examined before testing to ensure they are functional and a unique identification number will be permanently marked on each test item or set of test items. The locations of the identification number will be easily visible and consistent on all test items. A maintenance schedule will be established for each test item that adheres to the maintenance instructions provided with the test item by the developer. In the absence of maintenance instructions, normal procedures for maintaining like items in accordance with (IAW) the applicable technical manuals (TM)s will be followed.

b. Upon receipt, test item shipping containers will be inspected for damage. Test items and associated Service Support Package (SSP) will be unpacked and inventoried. Referencing criteria established in appropriate requirements documents, test items and SSP will be inspected for completeness, defects, and damage. Deficiencies will be recorded and photographed. Damaged or defective test items will be disposed of IAW test sponsor's directions.

c. Identification photographs will be taken of each item under test.

3.3 Test Planning.

Test preparations include preparing the test ranges and courses (if applicable) and selection, examination, and training of test participants (if applicable). Planning may require certain preliminary activities that should be included in the test plan, such as the following:

a. Identification and Coding. Test items need to be assigned a unique Test Item Control Number (TICN). The TICNs can be generated during test preparation as sequential

alphanumeric numbers that correspond directly and identify the specific test items submitted by the manufacturer, or can be the manufacturer's serial number. The TICN database, once created, will be easily assimilated into the overall test database to permit easy access to the individual records of each test item. The TICNs will serve as the means to quickly retrieve specific data corresponding to the test item, demographic data on the test participant, data collection information, or Test Incident Reports (TIRs). The TICNs must be marked or attached to the test items via a permanent process. The TICNs must be able to be used to track the test items from the initial receipt from the manufacturer through all Developmental Tests (DTs) and should be structured based on utility for multiple DTs and Operational Tests (OTs) when applicable. An overarching TICN assignment plan will often be developed to facilitate data integration when there are multiple test sites.

b. Medical. Medical examinations (e.g., condition of those portions of the body where treated materials come in contact with the skin or physicals if there is a requirement that the participant is physically able to perform the tasks required) or surveillance (such as for cold injury) of test participants may be a requirement for testing. If a medical examination is necessary for test participants, this will be done prior to starting the test. A medical record will be maintained on each participant if applicable to the test program.

c. Training and Familiarization. Test participants must be trained regarding the test items, mission scenarios, and test conditions to include the following:

(1) Description of test ranges, courses, and physical activities required during actual employment of the test item(s).

(2) Demonstration of and training on the test item and discussion of special characteristics and differences of currently employed systems. Discussion is to include safety aspects and proper methods of employment of the grenade launcher(s), along with any associated components that may be utilized concurrently.

(3) Identification of appropriate test personnel and processes through which participants should report any safety or health related issues.

d. Demographic Characterization. Prior to test initiation demographic data including date of birth (DOB), rank, months of service, handedness, and any other pertinent data should be collected from each participant.

e. ARs 40-38⁵ and 70-25⁶, should be reviewed and followed as appropriate when using human test subjects.

3.4 Test Controls.

a. Before testing begins, each prospective participant will be examined by qualified medical personnel to verify they are in acceptable physical condition for performing the intended test activities. Those individuals with physical conditions that would bias the test results or

endanger their health will not be used as test participants. Results of the medical examination will be a part of the privacy act release IAW AR 70-25.

b. If during testing, test participants are removed for medical reasons, they will undergo an immediate physical examination by a physician. The physician's report of the results of the examination, insofar as it reflects upon the ability of the individual to participate in the test, will be included in the test data. Results of the medical examination will be a part of the privacy act release IAW AR 70-25.

c. During testing, all or systematically varied groups of participants will be dressed with the identical type and amount of standard issue clothing. The level of clothing worn will be appropriate to the prevalent weather conditions and adhere to current Military Standards.

d. All tests will be conducted within the temperature range for which the item is designed, as determined from the requirements documents or the test directive. This temperature range will be divided into three equal divisions. At least one test will be conducted within the lower one-third of the lowest temperature range and one in the upper one-third of the highest temperature range. Lower limit temperatures should be pursued as often as possible during test.

e. If possible, a minimum of five test items will be used during each test.

f. Throughout testing, test participants will be observed for symptoms of cold injury. At the first symptoms, a test participant will be removed from testing, warmed, and examined by medical personnel if necessary.

g. At any phase of testing, if a test participant indicates unusual discomfort, the participant will be removed from testing and examined; participant safety will always be the priority.

h. Test procedures and quantitative limits specified in this TOP are based upon typical test design for a broad range of cold weather tests pertaining to grenade launchers. Some items may require variations from these procedures to accommodate specific needs.

i. Data collected throughout testing will be of sufficient quality and quantity to support conclusions. Since acquisition of such data may be constrained by limitation in the number of test or control items, manpower restrictions, inadequate time for optimum testing, or inadequate environmental conditions, the Test Officer will consult a statistician to identify optimum personnel, test item sample sizes, nominal equipment sizes, or the optimum number of repetitions or replications required in a particular operation.

3.5 Safety.

a. A complete safety and health hazard analysis should be made prior to and throughout the course of the test. A recommendation for a safety release must be submitted and approved prior to using Soldiers as test participants. This recommendation for a safety release will focus on those issues unique to the testing in a cold regions environment if the item(s) under test have a

previous safety release. During the initial inspection and maintenance, observations should be made through visual examination and functional checks for compliance in design to assure personnel safety. During the course of testing, any potential hazard observed during operations or maintenance actions must be recorded. All scheduled subtests should be considered in the overall safety and health assessment. All components must be safe or the hazards controlled to an acceptable level.

b. A safety release indicates a system is safe for use and maintenance and describes the specific hazard of the system, operational limits, and required precautions IAW Department of the Army (DA) Pamphlet (PAM) 73-1⁷, paragraph 6-64b. The safety release will have a specific start and end date, and is only valid for a specific time period or event. The test organization will reference this document in locally developed Hazard Assessment Working Group (HAWG), required by AR 385-10⁸ and DA PAM 385-10⁹. This local analysis should address likely additional risks posed by testing or operation in the cold regions environment.

c. During all weapons firing applicable range safety procedures will be closely adhered to. A qualified range Officer in Charge (OIC), range safety personnel, medical personnel, and emergency equipment (depending on the caliber of the weapon or type of system) will be physically present on the firing range.

4. TEST PROCEDURES.

Test procedures and quantitative limits specified in this TOP are based upon a typical test design for a broad range of cold weather tests regarding grenade launchers. Some items may require variations from these procedures to accommodate specific needs or test specific aspects of suitability and effectiveness.

4.1 Initial Inspection.

a. Upon receipt, test item shipping containers will be inspected for damage. Test items and associated SSPs will be unpacked and inventoried. Referencing criteria established in appropriate requirements documents, test items and SSPs will be inspected for completeness, defects, and damage. Deficiencies will be recorded and photographed. Damaged or defective test items will be disposed of IAW test sponsor's directions.

b. Perform necessary maintenance to correct shortcomings and deficiencies.

c. Install required instrumentation, record the nomenclature (model, serial number, date of calibration, physical location, etc.) of the devices used, if any, and verify their functionality.

d. Identification photographs will be taken of each item under test.

4.2 Physical Characteristics.

Characteristics and conditions of the test items at test start and throughout testing are a key part of the database. This is especially necessary when tracking bore wear and erosion.

4.3 System Safety.

a. Hazards related to use and testing in the cold regions environment, as well as any other unique hazards associated with the testing location or test item, will be recorded and reviewed for severity and frequency IAW Military Standard (MIL-STD)-882E¹⁰. Prior to starting the test, a HAWG will meet and discuss hazards and their mitigation. A formal hazard assessment and mitigating factors will be agreed upon and adhered to during the conduct of the test. Each hazard discussed will include a description, an initial Risk Assessment Code (RAC), the recommended mitigation, and a mitigated RAC.

b. Safety must be considered throughout the entire conduct of the test. Any hazards or potential hazards identified during the conduct of the test will be recorded, and if appropriate, the hazard risk will be classified IAW MIL-STD-882E. If there are specific safety and/or health issues or concerns identified in requirements documents, or considered necessary by the test team, a Safety Subtest should be incorporated in the test plan and front-loaded in the test program.

c. The US Army Test and Evaluation Command (ATEC) may ask for input from the Test Officer for completion of a Safety Confirmation. If asked, the Test Officer will supply the Safety Confirmation Recommendation to ATEC, ensuring it outlines all safety issues and appropriate mitigation factors. The Safety Confirmation indicates the system is ready for fielding, has a specific start date, and is valid indefinitely.

4.4 Firing.

4.4.1 Accuracy.

The objective of this subtest is to determine the accuracy of grenade launchers in the cold regions environment.

a. This test should be conducted when the weapons are in new condition. Requirements for specific weapons may dictate that certain parts of the test be repeated at the midpoint and end of weapon life. Cold soak all test and comparison weapons for at least eight hours.

b. Install or place standard grenade targets at ranges of 100, 150, 200, 250, 300, 350, and 400 meters (m).

(1) Except when specified otherwise, determine the coordinates of all targets. From the coordinate data, azimuth and range standard deviations, azimuth and range spread, mean radius, and deviation of the center of impact (CI) from the point of aim (when applicable) are provided.

(2) Zero all grenade launchers, whether utilizing electronic or iron sights, IAW with the TM or contractor provided technical documents.

(3) Fire three five-round shot groups with each grenade launcher at ranges of 100, 150, 200, 250, 300, 350, and 400 m. For weapon mounted grenade launchers, fire each sequence of shot groups from the prone supported, kneeling, and standing positions; for tripod or vehicle mounted systems perform all iterations based on operational configuration and employment. If the system under test is equipped with range finding capabilities, each target will be lased prior to engagement and the distance recorded.

c. Firing iterations up to and including 200 m should be conducted with wind conditions of 16 kilometers per hour (km/hr) or less and conducted at 8 km/hr or less for ranges in excess of 200 m.

d. Data required:

(1) Meteorological data.

(2) CI, mean radius, maximum vertical spread, maximum horizontal spread and maximum spread, at each range.

(3) Weapon malfunctions.

(4) Number of rounds fired through each system under test.

(5) Test participant surveys if applicable.

4.4.2 Rapid Fire.

The objective of this test is to determine the rate of fire of the grenade launcher as it is employed by the test participant.

a. This test should be conducted when the weapons are in new condition. Requirements for specific weapons may dictate that certain parts of the test be repeated at the midpoint and end of weapon life. Cold soak all test and comparison weapons for at least eight hours.

b. Install or place standard grenade targets at ranges of 100, 150, 200, 250, 300, 350, and 400 m.

c. For breach loading grenade launchers, test participants will assume a good firing position in the prone supported, kneeling, or standing position and on command fire 10 rounds as rapidly as possible, while maintaining proper marksmanship techniques. This should be repeated until all firing positions have been tested.

(1) Firing sequence should be timed from the moment the firing order is given until the last round is fired.

(2) Three iterations of each firing sequence will be conducted.

d. For automatic grenade launchers, test participants should load 100 rounds of linked munitions and on command fire as rapidly as possible while maintaining proper marksmanship technique.

(1) Firing sequence should be timed from the moment the firing order is given until the last round is fired.

(2) Three iterations of each firing sequence will be conducted.

e. Data required:

(1) Meteorological data.

(2) Weapon employment time.

(3) Weapon malfunctions.

(4) CI, mean radius, maximum vertical spread, maximum horizontal spread and maximum spread, at each range.

(5) Number of rounds fired through each system under test.

(6) Test participant surveys if applicable.

4.5 Suitability.

The objective of this subtest is to determine the ability of the test participant to transport the system under test cross-country and over ski trails utilizing standard issue clothing, equipment, snow shoes, and skis.

a. Cold soak systems for at least eight hours prior to the beginning of this subtest.

b. Test participants should wear Army standard cold weather clothing and equipment throughout this subtest. Test participants will perform the following:

(1) Snowshoe three miles through dense, snow-covered brush.

(2) Snowshoe five miles over open snow-covered terrain.

(3) Ski 10 miles over cross-country ski trails.

c. Dry-fire each launcher a minimum of 10 times during each of the above courses.

d. Data required:

- (1) Meteorological data.
- (2) Weapon malfunctions to include loose, damaged, or missing parts.
- (3) Excessive icing or other environmentally inhibitive events.
- (4) Test participant surveys.

4.6 Human Factors Engineering.

The objective of this subtest is to determine if all accessories and components of the systems under test enable easy operation by test participants wearing the appropriate cold weather clothing.

a. Test participants will be monitored and questioned throughout testing to determine if the system(s) under test are easily employable and compatible with currently fielded equipment.

b. Data required:

- (1) Test personnel observations.
- (2) Test participant surveys.

4.7 Maintainability.

The objective of this subtest is to determine if the system(s) under test meet the maintainability requirements as defined by established criteria in the cold regions environment.

4.7.1 Assembly/Disassembly.

a. Test participants will perform the following operations three times:

- (1) Completely disassemble the weapon.
- (2) Assemble the weapon after completely disassembling.
- (3) Disassemble the weapon to field-strip level.
- (4) Assemble from field strip.

b. Test participants will record all assembly/disassembly times.

c. These operations should be tested at the beginning, middle, and end of testing. This allows for a comparison of untrained and trained personnel.

4.7.2 Maintainability.

a. Throughout the duration of test, maintain a record of any scheduled and unscheduled maintenance tasks. Whenever possible, maintenance will be performed under prevailing environmental conditions. Any reasons why this is not possible will be recorded.

b. If performing a maintenance task that requires tools or special instruments, document any shortcomings in authorized tools and equipment and any needs for specialized tools and instruments to accomplish assigned levels of maintenance.

c. Record all parts replaced, man-hours, elapsed hours required, ease or difficulty of maintaining the test item, test item accumulated hours of wear, and level of skill required.

d. Beginning with the initial inspection of the test items, maintain a complete log of all assembly, operation, disassembly, and maintenance activities for the purpose of reliability analysis. The log will contain the following information:

(1) Hours of operation, daily and cumulative.

(2) Test item failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime, and mean time for repair.

(3) Effect of failures on the operational test conduct.

e. Data required:

(1) A record of all scheduled and unscheduled maintenance of the test items and associated equipment.

(2) Favorable and unfavorable aspects of maintenance.

(3) Unsafe and inadequate aspects of maintenance operations.

(4) Human Factors Engineering (HFE) implications.

(5) Comparison of reliability aspects for the test and control items.

(6) Any malfunction, breakage, or unusual occurrence as a result of testing.

(7) Comments on reliability based on observations made throughout the test.

(8) Tools and equipment used for maintenance operations.

(9) Tools and test equipment furnished but not required.

- (10) Accuracy and adequacy of maintenance publications.
- (11) Unclear instructions.
- (12) Inadequate TM procedures.
- (13) Special training requirements.
- (14) Errors and omission in nomenclature.

4.8 Battery Life.

This sub-test only pertains to grenade launchers that utilize electronic aiming/ranging devices. The objective of this subtest is to determine the maximum battery life (operating hours) of the system under test in the cold regions environment. Test personnel will:

- a. Utilize new batteries for the duration of the test. Batteries will be tested at a controlled temperature prior to and after testing; voltage will be recorded.
- b. Configure each system to operate in the appropriate mode, all deviations being annotated.
- c. Identify low battery warning and record the amount of time from initial warning to system shutdown.
- d. Test battery voltage once the batteries are removed.
- e. Data required:
 - (1) Initial battery voltage.
 - (2) Battery life (Of specific set).
 - (3) Final battery voltage.

4.9 Final Inspection.

- a. Upon completion of test, carefully inspect all test items for completeness, damage, and general conditions. Photograph any damage or deterioration reported. Technical manuscripts, manuals, or other publications supplied with the items will be used as guides for the inspection.
- b. Data required:
 - (1) Inventory all test items.

- (2) Any damage or deterioration.

5. DATA REQUIRED.

The required data are outlined in the preceding sections of the test procedures. For those test procedures that reference other TOPs, the data to be acquired are outlined in the referenced TOPs.

6. PRESENTATION OF DATA.

Data should be presented in tabular, graphical, or narrative format. The format that presents the most simple, readable format should be used in the final test report.

6.1 Initial Inspection.

Pre-operational inspection data will be organized, reduced, and presented in tabular format.

6.2 System Safety.

System safety observations and comments will be presented in tabular or narrative format, whichever is more readable and understandable. In certain cases, photographs should be included to clarify safety issues.

6.3 Firing.

Data obtained will be presented in tabular and graphical format. Table 2 shows an example of a firing data collection form. Photographs should be included when they enhance the data presented.

6.4 Suitability.

Data will be presented in tabular format. Photographs will often be necessary to document and effectively present specific suitability issues.

TABLE 2. SAMPLE FIRING DATA COLLECTION FORM

Weapon Model:					Ammunition Nomenclature:		
Weapon Serial Number:					Ammunition Lot:		
Optics Type and Model:					Ammunition Type:		
Optics Serial No.:					Target Type:		
Optics Mount Location On Rail:							
Trial No.	Temperature (°C)	Wind Speed (Knots)	Round Velocity	Distance To Target (m)	Maximum Vertical Spread	Maximum Horizontal Spread	Center Of Impact
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Comments:							

6.5 Human Factors Engineering.

The data obtained and observations made during performance of this subtest will be compared with accepted standards of human engineering. Observations of safety aspects associated with testing of the items will be recorded and presented in narrative format. Photographs will be presented as necessary.

6.6 Maintainability.

a. For ease of readability, maintenance actions should be summarized and presented in tabular format. Instances of inadequacy of manuals or repair tools/equipment encountered during the test should be listed in narrative or tabular format.

b. If TIRs were completed throughout the conduct of the test, then utilize the TIR summaries for narrative or tabular comments concerning required maintenance and maintenance man-hours. TIR summaries can provide detailed maintenance records that will aid in the calculation of maintenance, operational, and availability indices.

6.7 Final Inspection.

The overall condition of the test items will be briefly described after the completion of all testing and any problems that were not considered typical wear and tear will be highlighted.

APPENDIX A. ABBREVIATIONS.

Term	Definition
%	percent
μm	micrometer
AR	Army Regulation
ASP	Ammunition Supply Point
ATEC	Army Test and Evaluation Command
C	Celsius
C1	temperature ranges from a low -32 °C (-25 °F) to a high of -18 °C (0 °F)
C2	temperature ranges from a low of -46 °C (-50 °F) to a high of -37 °C (-35 °F)
C3	represents a day in which the temperature stays at the low of -52 °C (-60 °F)
CI	center of impact
cm	centimeters
DA	Department of the Army
DOB	date of birth
DT	Developmental Test
e.g.	for example
F	Fahrenheit
HAWG	Hazard Assessment Working Group
HFE	Human Factors Engineering
hpa	hectopascals
hr	hour
IAW	in accordance with
in.	inches
km	kilometer
m	meter
MIL-STD	Military Standard
OIC	Officer in Charge
OT	Operational Test

APPENDIX A. ABBREVIATIONS.

Term	Definition
PAM PMCS	Pamphlet preventive maintenance, checks, and services
RAC	Risk Assessment Code
SSP	Service Support Package
TICN	Test Item Control Number
TIR	Test Incident Report
TM	technical manual
TOP	Test Operations Procedure
TSARC	Test Schedule and Review Committee
US	United States
V	volt

APPENDIX B. REFERENCES.

1. TOP 03-2-030, Grenade Launchers, 13 March 1987.
2. Hazard Classification of US Military Explosives and Munitions REV 12, October 2007.
3. TOP 01-1-004, Cold Regions: Instrumentation Operation and Use, 10 October 2007.
4. AR 70-38, Research, Development, and Acquisition: Research, Development, Test and Evaluation of Materiel for Extreme Climate Conditions, 15 September 1979.
5. AR 40-38, Medical Services: Clinical Investigation Program, 01 September 1989.
6. AR 70-25, Research and Development: Use of Volunteers as Subjects of Research, 25 January 1990.
7. DA PAM 73-1, Test and Evaluation: Test and Evaluation in Support of Systems Acquisition, 30 May 2003.
8. AR 385-10, Safety: The Army Safety Program, Rapid Action Revision, 4 October 2011.
9. DA PAM 385-10, Safety: Army Safety Program, Rapid Action Revision, 19 January 2010.
10. MIL-STD-882E, Department of Defense Standard Practice: System Safety, 11 May 2012.

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APPENDIX C. APPROVAL AUTHORITY.

CSTE-TM

~~25~~ January 2013

MEMORANDUM FOR

Commanders, All Test Centers
Technical Directors, All Test Centers
Directors, US Army Evaluation Center
US Army Operational Test Command

SUBJECT: Test Operations Procedure (TOP) 03-4-005A, Cold Regions – Environmental Testing of Grenade Launchers, Approved for Publication

1. TOP 03-4-005A, Cold Regions – Environmental Testing of Grenade Launchers, has been reviewed by the US Army Test and Evaluation Command (ATEC) Test Centers, the US Army Operational Test Command, and the US Army Evaluation Center. All comments received during the formal coordination period have been adjudicated by the preparing agency. The scope of the document is as follows:

This TOP provides testing guidelines for grenade launchers in a cold regions environment. The primary goal of this TOP is to outline procedures that will determine the performance, reliability, durability, and safety of grenades launchers when exposed to a cold regions environment.

2. This document is approved for publication and has been posted to the Reference Library of the ATEC Vision Digital Library System (VDLS). The VDLS website can be accessed at <https://vdl.s.atc.army.mil/>.

3. Comments, suggestions, or questions on this document should be addressed to US Army Test and Evaluation Command (CSTE-TM), 2202 Aberdeen Boulevard-Third Floor, Aberdeen Proving Ground, MD 21005-5001; or e-mailed to usarmy.apg.atc.mbx.atc-standards@mail.mil.

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Forward comments, recommended changes, or any pertinent data which may be of use in improving this publication to the following address: Range Infrastructure Division (CSTE-TM), US Army Test and Evaluation Command, 2202 Aberdeen Boulevard, Aberdeen Proving Ground, Maryland 21005-5001. Technical information may be obtained from the preparing activity: Test Management Office (TEDT-YPC-TM), US Army Cold Regions Test Center, PO Box 31350, Fort Greely, AK 99731. Additional copies can be requested through the following website: <http://itops.dtc.army.mil/RequestForDocuments.aspx>, or through the Defense Technical Information Center, 8725 John J. Kingman Rd., STE 0944, Fort Belvoir, VA 22060-6218. This document is identified by the accession number (AD No.) printed on the first page.